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Technical News Bulletin No. 65

September 15, 1922.

GENERAL NOTE

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

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1 Testing of Automobile Engines Under Service Conditions

The testing of an automobile engine in a laboratory or testing room is a comparatively simple matter. The engine may be mounted on a suitable stand and operated at constant speed and power output, the power being directly transmitted to some apparatus, such as an hydraulic brake or electric dynamometer, which serves to measure and dispose of the power generated, while the rate of fuel consumption can be determined very accurately in a number of different ways.

The conditions of such a test, however, are not identical with those under which an engine operates when driving a car on the road, since in actual service the power output and rate of fuel supply are continually changing, and the support of the engine itself is in motion. It can readily be imagined that the testing of an engine on the road is much more difficult than on the testing stand. The rate of fuel supply is not constant, and it is, therefore, necessary to devise a means of recording the rate of supply at any instant.

Likewise, in actual service the power generated is disposed of in a large number of ways, such as overcoming friction of moving parts, in so-called rolling losses of tires, in overcoming wind resistance, in accelerating the car, in climbing grades, etc. It is, therefore, necessary to measure the record of these factors separately and add them to find the power output at any instant.

The Bureau of Standards has recently completed the design and construction of apparatus necessary for making such tests, and although, as may be inferred from the nature of the problem, the apparatus is complex, it has been reduced to a very compact form, so that it can be installed in a car in about one day. The apparatus consists of a photographic recorder, which records the rate of fuel consumption, and another instrument with recording pens which gives on a single strip of paper a record of the following quantities: (1) Engine speed; (2) manifold depression; (3) temperature of inlet water; (4) temperature of outlet water; (5) temperature of oil; (6) temperature of the differential; (7) temperature of air at the entrance to the carburetor; (8) temperature of the atmospheric air; (9) weight of air being used by the engine; (10) acceleration of the car; (11) air speed, and (12) apparent direction of wind.

The record so obtained makes it possible to determine not only the power generated by the engine, but also how its power is used. If it should appear from the record that an excessive amount of power is being absorbed in any one part of the mechanism, improvements in design to reduce the losses would be called for. Systematic tests with apparatus of this kind should result in pointing out where improvements in designs of engines and cars are most needed and may be expected to result in improved designs of greater efficiency than those now in use.

A full description of the apparatus is to be published in the Journal of the Society of Automotive Engineers.

2 Motor Vehicle Lighting Problems

In Bulletin No. 63, mention was made of the work which the Bureau has been conducting in cooperation with the various states on the proper illumination of automobile license plates and their visibility under different conditions of illumination. During the past month this work has been continued, but the observations made up to the present time are merely preliminary and include only a few of the conditions under which plates must be legible.

This work is being conducted in connection with a committee of the Illuminating Engineering Society and with officials of several states. A large number of license plates have been obtained, and the work will be continued as soon as possible. Along this line, it is expected that later some investigations will be undertaken to determine the best form of numerals for these plates.

3 Tests of Tires

The work which the Bureau has been conducting on the endurance testing of automobile tires has been previously mentioned. Up to date about 15 tires have been run to failure on the endurance machine, and it is gratifying to note that tests of several tires of the same make show consistent

results. The mileages obtained on 30 x 3 1/2 fabric tires have ranged from 1000 to 4000 miles. A direct current motor has been installed so that the machine may be run at night as well as during the day thus shortening the time necessary for a complete test.

Several more tests on the power losses in tires have been completed, and some of this work is being conducted in cooperation with the automotive laboratory of the Bureau which has been carrying out road tests on complete cars.

One tire manufacturer has requested a series of dynamometer tests on tires of several different constructions, and it has been agreed to carry out this work, as the results will be of interest in connection with the general power loss investigations.

4 Specifications for Dry Cells

Specifications for dry cells have been further considered during the past month. Mimeographed copies of the specifications were sent about the end of July to those who attended the conference held December 5 of last year. Replies accepting the specifications have been received from several manufacturers and users of batteries. In this connection, a conference has been held with a representative of the Signal Corps as a result of which it has been found that two slight changes were needed in the specifications to satisfactorily cover the requirements of that organization.

The specifications were considered finally by a committee of the American Railway Association which met at the Bureau on August 22, during which the representatives of the railroads prepared specifications for the No, 6 size of dry cell for railway use which are in complete accordance with those prepared by the Bureau. The specifications for dry cells are now complete and can be finally adopted.

5 Comparison of the Bureau's and Manufacturers' Tests for Dry Cells

Comparative tests have been carried out in the laboratory of the Bureau of Standards and in several laboratories of manufacturers to check the methods employed for testing dry cells. A comparison of the results shows a good agreement between the Bureau's laboratory and that of a large manufacturer of flashlight batteries, and between the Bureau's laboratory and another large producer on the 10-ohm continuous test and the heavy intermittent test. A discrepancy appeared, however, between the results obtained in these two laboratories on the light intermittent test. In order to discover the cause of the variation, a member of the Bureau's staff was sent to the manufacturer's laboratory with a portable bridge and voltmeter to thoroughly check their circuits. No particular difficulty was found in the resistance of the circuit, but the voltage readings appeared to be somewhat erratic. After a thorough investigation, the Bureau's apparatus appears to be in perfect condition.

6 The Tarnishing of Silver

The investigation to discover the reason for the tarnishing of silver has been in progress throughout the month. Tests show clearly that sterling silver is tarnished more readily than pure silver, and that copper is tarnished most readily of all. The principal purpose of the work during the past month has been to determine the relative amounts of tarnish caused by various mixtures of hydrogen sulphide and sulphur dioxide.

7 Redetermination of Secondary Standards of Wave Length

In connection with the redetermination of secondary standards of wave lengths from the iron arc, 12 interference spectrograms were measured and reduced to wave length comparisons with cadmium and neon lines.

The results indicated that the international standards are too small by about 1 part in 2 000 000. To check this, 3 additional spectrograms were made, exposing the iron and neon light sources simultaneously to eliminate any question of changes in the interferometer. These show the same result. The point will be tested again by simultaneous exposure of iron and cadmium sources.

8 Practical Spectrographic Analysis

Scientific Paper No. 444 of the Bureau of Standards will soon be ready for distribution from the Superintendent of Documents, Washington, D. C., at 10¢ per copy. It reviews briefly the various methods which have been proposed for chemical analyses by means of the spectrum, and then continues with a detailed description of the principle, apparatus, and procedure employed in making quantitative analyses from the spectra of condensed sparks.

The principle is based on the well known fact that if one examines the spectra of flames, arcs or sparks, either visually or photographically, it is seen that with the diminution of an element in a mixture its spectrum becomes simplified, more and more lines disappear, so that in general only one extremely sensitive line remains when a minute trace of the element is present. From a study of standard samples whose chemical composition is known, the partial spectrum of each element may be correlated with the amount present, thus furnishing a basis for estimating the composition of impure materials. Such tests have the widest application and are best controlled and interpreted when the materials are made luminous in a high potential capacity spark and the spectra of standard and unknown samples are photographed for comparison. The practical application of this method is illustrated by 3 examples taken from the work of the [illegible] spectroscopy section of the Bureau. They deal with the quantitative determination of impurities in various samples of tin, gold, and platinum. This spectrographic method of analysis is especially sensitive and useful in nearly all cases where small quantities of samples or impurities are to be tested and can, therefore, be used to advantage in

supplementing assays or the wet methods of chemical analysis which in many such cases are difficult and uncertain. For routine work of this nature, a standardized spectrographic method will furnish results of considerable accuracy and will reduce the time and expense involved by the more tedious methods. Other applications to problems in chemistry, metallurgy, mineralogy, physics, biology, etc., are suggested.

9 Ultra-Violet Rays for Bleaching Low-Grade Wheat Flour

The Bureau of Standards is frequently asked to pass judgment upon all sorts of novel devices and methods. Recently its opinion was asked by the Department of Agriculture as to the effectiveness of utilizing ultra-violet rays in the bleaching of low-grade wheat flour. Since cellulose is turned brown by ultra-violet rays, the opinion rendered was that instead of bleaching the flour, its color would be changed to brown. The following day a sample of flour was exposed for 5 minutes to the radiations from a quartz mercury arc lamp with the result that the flour was turned brown showing that no bleaching was obtained, and that even if the rays exerted a bleaching effect, the method would be impracticable.

10 Gases in Embrittled Boiler Plate

Determinations of gases were made on samples of boiler plate which had failed from caustic embrittlement. One sample was from a boiler which had been in service for several years, the second from a boiler only in service a few months. Analyses for gases were made on samples representing the material from the center of the plate where no cracks had developed and from the edge of the plate between rivet holes where cracks had developed. There was but little variation between the combined nitrogen content of the center and the edge of the same plate or between the different plates.

The results for oxygen and hydrogen by the vacuum fusion method with antimony tin alloy indicated .02 to .03% oxygen and .0020 to .0030% of hydrogen in the plate.

Further determinations are being made to detect variations in oxygen and hydrogen between the edge and center of these plates.

11 New Method for Determining Total Nitrogen in Steel

Preliminary tests of a new method for determining both combined and uncombined nitrogen in iron and steel confirm the belief that the method will determine and make more certain the extent of uncombined nitrogen in steel, namely, nitrogen which is not determined by the Allen method.

The new method depends on the absorption in calcium vapor of all the gases evolved from the steel sample when fused in vacuo. The nitrogen is fixed as calcium nitride which is then readily determined by solution in acid and distillation with sodium hydroxide.

12 Inundated Sand Investigation

The Bureau of Standards has started an investigation to determine the feasibility of measuring sand for concrete in an inundated condition. With small additions of moisture to sand, the sand "swells," that is, the volume occupied by a given quantity of sand increases, and this increase sometimes reaches an amount as large as 38% of the original volume. Conversely, the quantity of sand in a measure of given size varies greatly with the amount of moisture in the sand. This fact makes it difficult to insure the same proportion between sand and cement in successive batches of concrete because the percentage of moisture in sand varies greatly from time to time. Preliminary investigations have indicated that if the vessel in which the sand is measured contains sufficient water to submerge the sand, the same quantity of sand can be placed in the vessel regardless of the quantity of moisture originally obtained.

The investigation is to determine whether the measurement of sand inundated will effect uniformity in the proportioning of sand to cement and consequently uniformity in the strength of the concrete. An affirmative answer to this question would mean the solution of one of the most troublesome problems in the concrete industry.

13 Special Test of Grain Hopper Scale

In compliance with a request from the State Inspector for the State of Missouri, a representative of the Bureau visited Kansas City and conducted a test on a 120 000-lb. capacity hopper scale installed for weighing grain in a large mill. This scale was reported to be the latest design produced by the manufacturer and had been tested and adjusted sometime previously.

The main purpose of the test was to illustrate and explain the precision test of large capacity scales according to the method which has been developed by the Bureau of Standards, and by means of which it is possible to test a scale with great accuracy and at the same time obtain a record of the events in such detail that variations in the action of the mechanism or mistakes in conducting the test are very clearly disclosed.

Following the test a conference was held at which the method of conducting the test was discussed and outstanding questions were cleared up. The state and city representatives believe that they now understand the Bureau's method and with a little practice will be able to carry out similar tests.

14 Large Cast Iron Scale Levers

Cast iron is generally used for scale levers, but it is a difficult matter to get good quality in large members. This is particularly important in heavy capacity scales where the levers are subjected to bending stresses. During the month a representative of the Bureau visited a western scale factory and examined some very large railroad track scale

levers of unusually good external appearance. Two of the levers had been rejected on account of the fact that the mould had been weakened by burning and distorted in handling. The condition of the iron on the interior of the lever was of special interest to the Bureau, and through the courtesy of the manufacturer, one of the rejected levers was broken across at two sections. Both of the breaks were found to be free from blow holes or other flaws.

The experience of this manufacturer appears to be in accord with that of others respecting the use of cast iron for heavy levers instead of steel. While for a given strength steel will produce a lighter lever, the cast iron, when satisfactory castings are secured, seems to work out the better. A cast iron piece is not as stiff as a steel one from the same pattern, but in practice the cast iron levers are stiffer as the material added to give the necessary strength results in greater stiffness than would be secured in a lighter steel one for the same purpose.

15 Standardization of Numbered Duck

The work on the standardization of numbered cotton duck has been completed. The results have been accepted by the Cotton Duck Association and by the Federal Specifications Board, and the specifications are now in the hands of the Textile Committee of the American Society for Testing Materials for their consideration and the adoption of the test methods incorporated in the specifications.

16 Soap Specifications

Owing to the diversity of the requirements for the same kind of soap as set forth in the specifications issued by the various government departments, municipalities, etc., the Bureau of Standards, several years ago, undertook to unify certain soap specifications and, after conferences with representatives of the government departments and correspondence with a large number of manufacturers, issued Circular No. 62 on "Specifications for and Methods of Testing Soaps." This circular served a useful purpose for a time, but owing to changes in the industry, the manufacturers requested a revision that would conform to the present commercial products. Little was accomplished in this direction however, until the manufacturers appointed a technical committee, representing about 9/10 of the industry in this country, to confer with a technical committee appointed by the Federal Specifications Board. The manufacturers' committee gave valuable assistance and as a result of the conference specifications for white floating soap, liquid soap, soap powder, salt water soap, automobile soap, chip soap, ordinary laundry soap, grit cake soap, scouring compounds, and hand grit soap were agreed upon. These specifications are considered as fair to manufacturer and consumer and should secure a product suitable for the intended

use, and allow wide freedom in the selection of stock that is consistent with quality, so that the manufacturer can take advantage of both varying market conditions and advances in the technology of fats and oils. The specifications cover general descriptions of the products desired, basis of purchase, the limits for useful, harmful, or neutral constituents, and the details as to the methods of sampling and testing. These specifications were promulgated as U. S. Government Standards by the Federal Specifications Board on June 20, 1922, and have been published as Circulars Nos. 123 to 132 of the Bureau of Standards. They may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5¢ a copy.

PUBLICATIONS OF THE BUREAU OF STANDARDS RELEASED DURING AUGUST.

Scientific Papers

S 440 The spectral transmissive properties of dyes: I. Seven permitted food dyes, in the visible, ultra-violet, and near infra-red. K. S. Gibson, H. J. McNicholas, E. P. T. Tyndall, M. K. Frehafer (Bureau of Standards) and W. E. Mathewson (Bureau of Chemistry). 15¢

S 443 Measurement of the color temperature of the more efficient artificial light sources by the method of rotatory dispersion. Irwin G. Priest 5¢

Circulars

C 87 U. S. government specification for zinc oxide(2d.ed) 5¢

C 89 U. S. government specification for white paint and tinted paints made on a white base, semipaste and ready mixed. (2d. ed.) 5¢

C 94 U. S. government specification for black paint, semi-paste and ready mixed. (2d. ed.) 5¢

C 103 U. S. government specification for water-resisting spar varnish. (3d. ed.) 5¢

C 123 U. S. government specifications for white floating soap 5¢

C 124 U. S. government specifications for liquid soap. 5¢

C 125 U. S. government specifications for soap powder. 5¢

C 126 U. S. government specifications for salt water soap. 5¢

C 127 U. S. government specifications for automobile soap. 5¢

C 128	U. S. government specifications for chip soap.	5¢
C 129	U. S. government specifications for ordinary laundry soap.	5¢
C 130	U. S. government specifications for grit cake soap.	5¢
C 131	U. S. government specifications for scouring compounds.	5¢
C 132	U. S. government specifications for hand grit soap.	5¢

These publications may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices given above.

Respectfully,

S. W. STRATTON

Director
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